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GB 2070533 A GB 0780654 A GB 0503273 A
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(54) Abstract Title
Vehicle engine and transmission arrangement

(57) A vehicle transmission has a longitudinally-arranged engine output shaft 2 which extends forwards through a hollow gearbox shaft 7 to drive a flywheel and clutch assembly 8 at the opposite end of the gearbox from the engine. The output of the clutch drives the shaft 7 of the gearbox and the output of the gearbox drives a transversely-arranged differential 37 and axle 38. The arrangement of the engine behind the gearbox and final drive and the flywheel and clutch in front improves weight distribution. The drive shaft 2 may extend forwards of the flywheel/clutch assembly to carry a pulley 24 for driving auxiliary or ancillary apparatus such as an air conditioning pump.

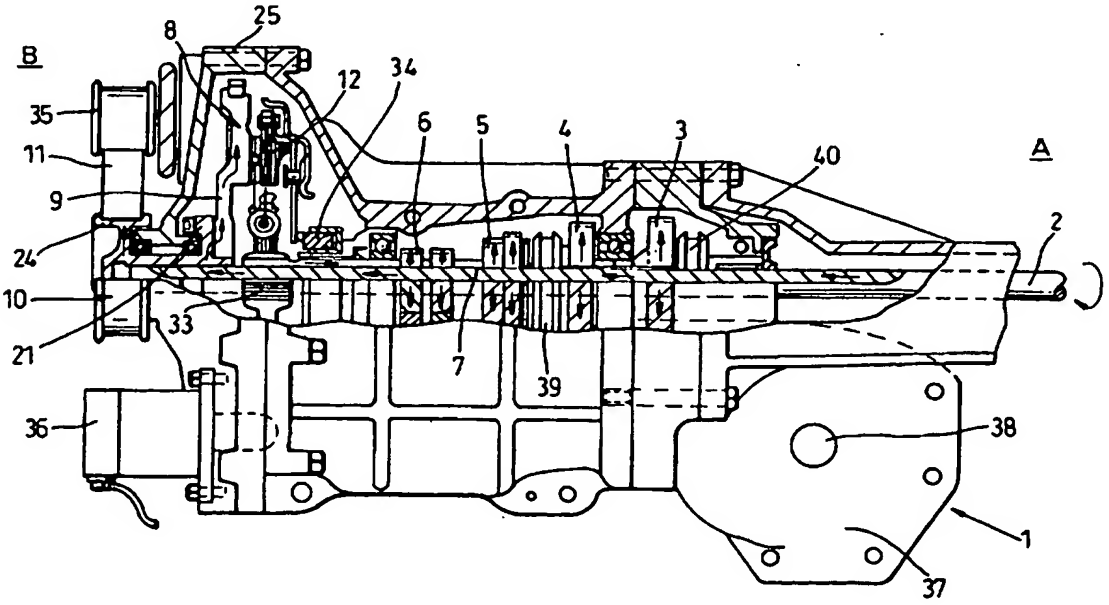

Fig. 1

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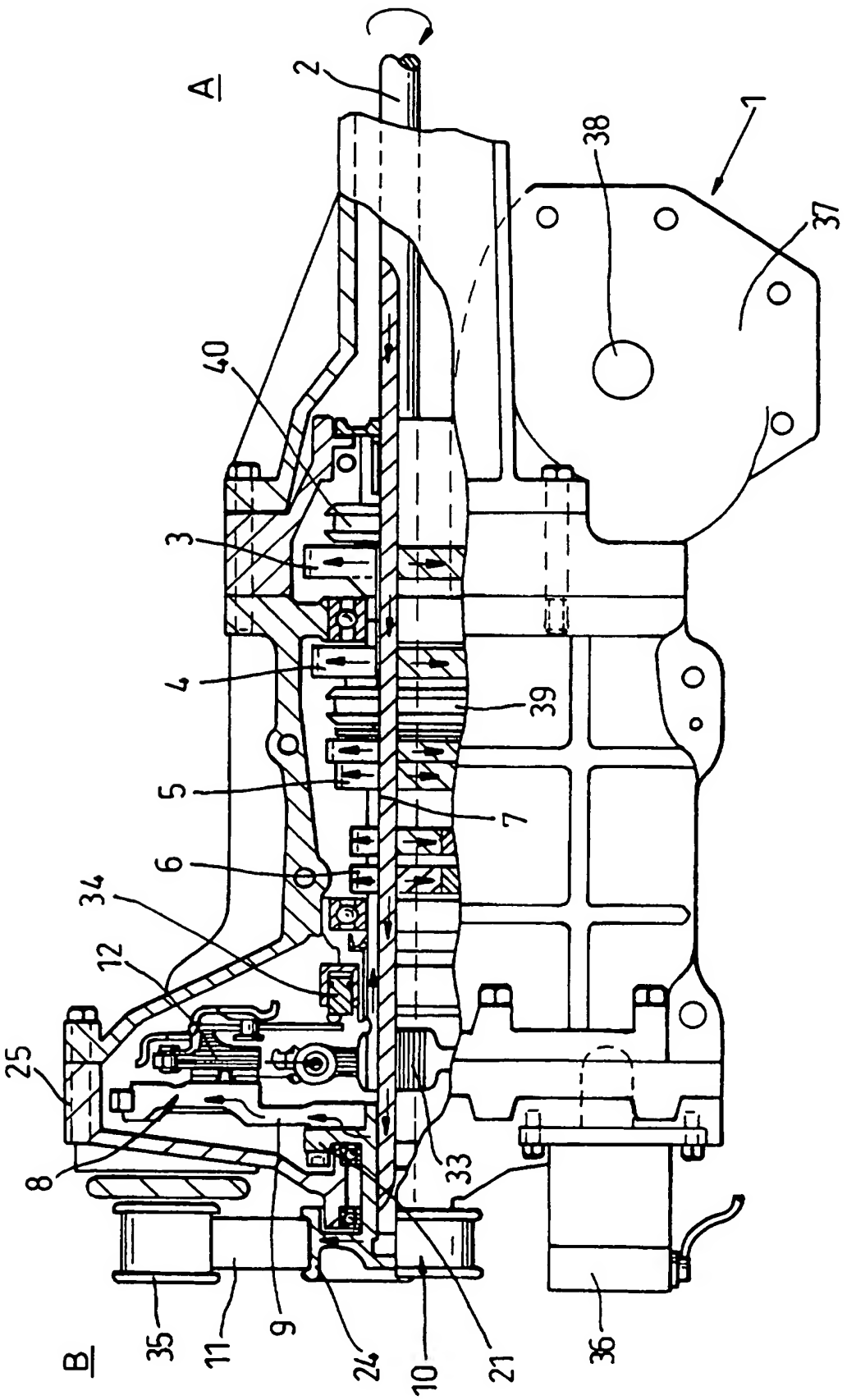

Fig. 1

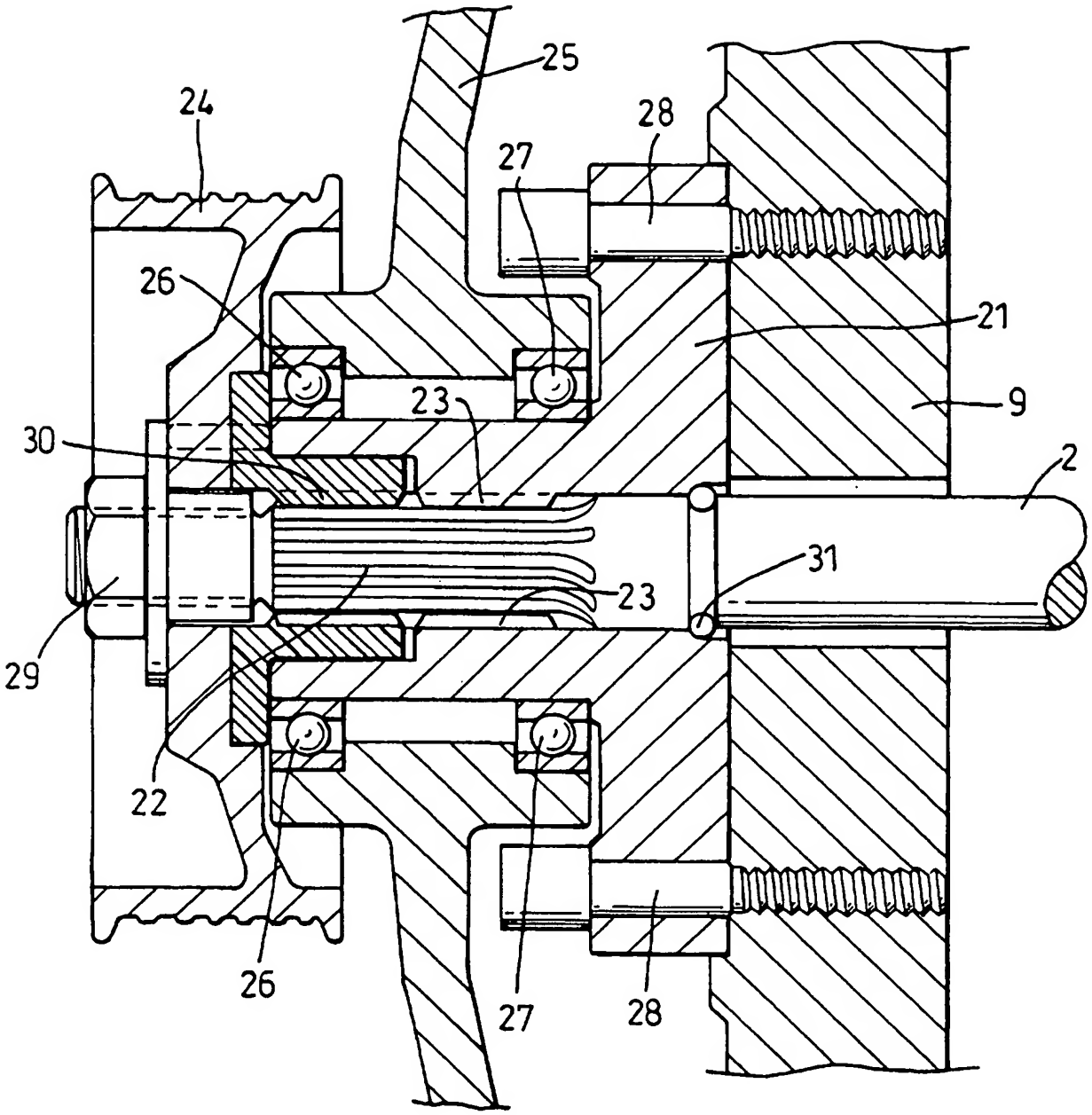

Fig. 2

A Vehicle

The present invention relates to a vehicle and more particularly to a vehicle configuration in which better weight distribution can be achieved.

In a vehicle configuration of a so-called in-line form, the prime mover or power unit i.e. the engine of a vehicle is behind the transmission gearbox. Thus, location of the clutch/flywheel assembly between the power unit and the trans-axle is dictated by a conventional gearbox design. It will be appreciated that the clutch/flywheel assembly has a significant mass which should be desirably located at the most convenient position within the vehicle for ready access for maintenance and servicing.

Regrettably, conventional gearbox design does not facilitate desired weight distribution and servicing with regard to so-called in-line vehicle configurations.

It is an object of the present invention to provide a vehicle in which the transmission gearbox arrangement is provided which substantially overcomes the above mentioned problems.

In accordance with the present invention there is provided a vehicle comprising a prime mover having a drive shaft, a transmission having a gear train and a flywheel/clutch assembly, the vehicle being configured with the transmission forward of the prime mover such that the drive shaft passes through a hollow path in the gear train to the flywheel/clutch assembly in order to drive that flywheel/clutch assembly and that flywheel/clutch assembly is coupled to the transmission in order to drive the gear train and so the vehicle.

Also in accordance with the present invention there is provided a transmission arrangement for a vehicle, the arrangement comprising a gear train

arranged whereby there is a hollow path defined therethrough in order to accommodate a drive shaft which is coupled to a prime mover on one side of the arrangement and a clutch/flywheel assembly on the other whereby a prime mover may drive the drive shaft and the clutch/flywheel assembly may drive the transmission arrangement.

Typically, the hollow path will be located centrally within the gear train.

The drive shaft may extend beyond the flywheel/clutch assembly in order to provide a power coupling for auxiliary equipment such as an air conditioning unit pump, water pump or PAS pump along with an alternator arranged to charge a vehicle battery . Typically, this power coupling will comprise a pulley end to the drive shaft upon which a drive belt or chain may be driven for the respective auxiliary equipment or alternator.

The flywheel/clutch assembly may be associated with a starter motor by which through coupling through the drive shaft the prime mover may be activated.

An embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figure 1 is a side elevation with partially exposed cross-section of a transmission arrangement for a vehicle; and

Figure 2 is a cross-section of a drive shaft coupled to a clutch/flywheel assembly of a vehicle.

Operation of vehicle transmission arrangements is well known to those skilled in the art. Thus, reference is made to such knowledge with regard to general

operation of the present invention with respect to transmission of motive power from a prime mover engine of a vehicle to a drive wheel of that vehicle.

Figure 1 illustrates in side cross-section with partially exposed interior a transmission arrangement in accordance with the present invention. Thus, a prime mover (not shown) is coupled to a drive shaft 2 of the arrangement 1.

The transmission arrangement 1 includes a gear train or cluster comprising several gears 3, 4, 5, 6 secured about a hollow shaft 7 which in turn is coupled to a flywheel/clutch assembly generally shown as 8 within Figure 1. It will be understood that the gears 3, 4, 5, 6 and shaft 7 may be all integrally formed together or assembled from discrete components. The drive shaft 2 passes through the hollow shaft 7 in order to be coupled to the flywheel 9. Furthermore, the drive shaft 5 may extend beyond the flywheel 9 in order to provide an additional power coupling in the form of a pulley 10 upon which a drive belt 11 can be located in order to drive ancillary equipment such as an air conditioning pump or in order to provide appropriate ignition traction from a starter motor to the shaft 2 and therefore the prime mover engine (not shown).

Essentially, the present invention allows the prime mover engine to be located upon one side A of the transmission arrangement 1 which is opposite to a side B where the clutch/flywheel assembly 8 is located. In such circumstances, it will be understood that the weight distribution across the transmission arrangement and therefore a vehicle in which the arrangement 1 is located is more evenly balanced. In order to provide this configuration of vehicle and transmission arrangement 1 it will be understood that the drive shaft 2 is located concentrically within the gear train shaft 7 in order to drive the flywheel 9. This flywheel 9 in turn can be coupled to a clutch 12 secured to the gear train shaft 7 in order to drive the respective gears 3, 4, 5, 6 as required and selected by a driver of the vehicle.

Clearly, the clutch 12 can be dis-engaged from the flywheel 9 in order to allow gear selection and ignition of the prime mover engine of the vehicle through the drive shaft 2.

It will be understood the drive shaft 2 and the gear train shaft 7 will rotate generally in the same direction.

Figure 2 illustrates in greater detail and side elevation a manner of coupling the drive shaft 2 to the flywheel 9 via a flywheel carrier 21 bolted to that flywheel 9. Thus, the drive shaft 2 has a splined end 22 which is engaged by teeth 23 of the carrier 21. In such circumstances, it will be appreciated that any drive rotation of the drive shaft 2 will be coupled through the splined end 22 and teeth 23 to the carrier 21 and subsequently to the flywheel 9.

As shown in Figure 1 typically the drive shaft 2 will extend beyond the flywheel/carrier 21 combination in order to provide a power coupling for ancillary equipment and/or a manner for providing ignition drive through the shaft 2 to the prime mover engine of the vehicle (not shown). Thus, bolted to the end of the shaft 2 is a pulley 24 such that again power with rotation of the shaft 2 is directly coupled to that pulley 24.

Clearly, in order to facilitate such relative rotation of the shaft 2, flywheel 9/carrier 21 and pulley 24 relative to a flywheel/clutch casing 25 it is necessary to provide bearings 26, 27. It will also be understood that appropriately robust fastenings 28, 29 are required to ensure assembly of the various components of the present transmission arrangement is sufficiently sturdy to resist the inherent transient and ongoing mechanical loads associated with vehicle motion. Similarly, in order to ensure consistent splined end 22 location relative to the teeth 23 of the flywheel carrier 21 and teeth 30 of the pulley 24 carrier, it is necessary to include a

shaft locating device 31 such as a circlip which engages a ridge or groove in the shaft 2 and in the carrier 21.

It will be understood that in order to facilitate operation generally the mass of the flywheel 9 and associated clutch assembly will be taken by other bearings not shown in Figure 2.

Generally, the teeth 23, 30 of the respective carrier 21 and pulley 24 carrier will be counter torqued and then locked by the pulley nut 29 to eliminate radial free movement in the teeth 23, 30 and the splines of the splined end 22 of the shaft 2. It will also be understood that the effect of the pulley nut 29 will be to draw the shaft 2 towards the flywheel carrier 21 and the locating device 31 such that axial movement of the shaft 2 is similarly constrained and substantially eliminated.

Returning to Figure 1, it will be noted that the drive shaft 2 concentrically located within the gear train shaft 7 will thus typically is located centrally within the respective gears 3, 4, 5, 6 such that these gears 3, 4, 5, 6 can rotate together about their respective shaft 7 in order to drive a vehicle.

The drive shaft 2 and the gear train shaft 7 as indicated previously are rotating in use. Thus, it is essential that an appropriate bearing arrangement is provided to ensure separation of these shafts 2, 7 despite shock and operational mechanical loading and other factors such as thermal expansion, wear and assembly tolerance stack-up. Typically, the space between the concentric shafts 2, 7 will incorporate or be packed with bearings and lubricants.

As with the drive shaft 2, the gear train shaft 7 will be coupled to the clutch 12 through a spline combination 33 such that a splined end of the gear train shaft 7 is engaged by teeth of the clutch 12 such that there is driven rotational coupling

therebetween. As indicated above, operation of flywheel 9/clutch 12 assemblies is well known to those skilled in the art thus, reference is made to that knowledge in order to provide specific understanding as to power transfer from the flywheel 9 through the clutch 12 to gear train shaft 7. However, in essence, the flywheel 8 and clutch 12 are bought into compressive engagement such that there is at least a friction coupling therebetween in order to provide rotational motion to the shaft 7. In such circumstances, it will be appreciated that the normal configuration of the flywheel 9 and clutch 12 will be with a substantial compressive force therebetween and so in order to dis-engage the flywheel 9 and clutch 12, or otherwise provide a de-coupling of power, an hydraulic cylinder 34 will be used to dis-engage the flywheel assembly 10 from transmitting power from the drive shaft 2.

As indicated previously, a pulley 24 is arranged upon an end of the drive shaft 2 and can drive a belt 11 which in turn is associated with a pulley 35 associated with an auxiliary or ancillary apparatus. Thus, an air conditioning pump or water pump can be driven by the drive shaft 2 through the pulley 24, belt 11 and pulley 35.

Clearly, a starter motor 36 is also a component with significant mass. Thus, as illustrated in Figure 1, association of that starter motor 36 upon one side B of the transmission arrangement away from side A of the prime mover engine will also provide better weight balance within a vehicle. In such circumstances, the starter motor 36 will turn over the prime mover engine through the drive shaft 2 appropriately coupled to that starter motor 36 with adequate mechanical advantage for such operation. Thus, the drive shaft 2 rather than normally being the driver for the gears 3, 4, 5 will itself be driven by the motor 36 in order to initiate rotation of the prime mover engine. Clearly, the starter motor 36 will act typically through a coupling to the flywheel 9 perimeter in order to rotate and drive the shaft 2 for prime mover engine ignition pick-up.

The gears 3, 4, 5 will drive as appropriate a main shaft (not shown) such that in a differential casing 37 a respective trans-axle 38 for wheels is driven in order to move the vehicle associated with the transmission arrangement 1. Such drive power distribution is well known to those skilled in the art.

In order to more fully understand the driven power flow through the transmission arrangement 1 arrowheads are provided. Thus, in normal operation, powered rotation of the drive shaft 2 flows in the direction of arrowheads associated with that shaft 2 through the splined end and flywheel carrier into the flywheel 9 and then the clutch 12 such that via the splined end 33 to the gear train shaft 7 power is provided selectively to the gears 3, 4, 5, 6 as required by a driver of the vehicle. Selection of these gears 3, 4, 5, 6 is through selector forks (not shown) associated with collars 39, 40 which can slide the gears 3, 4, 5, 6 upon the shaft in an axial direction as required for specific transmission requirements.

It will be understood that with the flywheel/clutch assembly 8 in front of both the gear train of the arrangement 1 and the prime mover engine that the cross-section presented to a bulkhead is limited until contact with the flywheel/clutch assembly 8 is reached during a vehicle collision.

By allowing ancillary/auxiliary equipment to be located along with the starter motor 6 at a forward position relative to the arrangement 1 and the vehicle prime mover engine it will be understood that the additional benefits of weight distribution, service/maintenance access and ease of installation are additional benefits of the present invention. It will also be understood that generally the transmission assembly 1 being located in front of a prime mover engine will itself allow easier access for service and maintenance of particularly the clutch in the arrangement 1.

Finally, those skilled in the art will appreciate that where a vehicle configuration is provided such that the engine is located behind the transmission arrangement 1 the present invention avoids relatively complicated transfer gears and minimises transmission synchronisation inertia loads along with avoiding relatively complicated gear change linkages such that there will be an inherent improvement in durability and gear change quality as compared to previous arrangements.

As an alternative to use of splined joints between the shaft 2 and the flywheel carrier 21 along with between the clutch 12 and the gear train shaft 7, it will be understood that a taper joint and key or a parallel interference with drive pin coupling could be utilised dependent upon requirements.

In summary, in accordance with the present invention drive is passed through the drive shaft 2 and then back through the clutch 12 to the input side of the gear train or cluster 3 to 6.

CLAIMS

1. A vehicle comprising a prime mover having a drive shaft, a transmission arrangement having a gear train and a flywheel/clutch assembly, the vehicle being configured with the transmission forward of the prime mover such that the drive shaft passes through a hollow path in the gear train to the flywheel/clutch assembly in order to drive that flywheel/clutch assembly and that the flywheel/clutch assembly is coupled to the transmission in order to drive the gear train and so the vehicle.

2. A vehicle as claimed in claim 1 wherein the hollow path is central through the gear train of the transmission such that a gear train shaft upon which respective gears of the gear train are located essentially defines the hollow path through which the drive shaft is concentrically located.

3. A vehicle as claimed in claim 1 or claim 2 wherein at one end of the drive shaft there is a power coupling which may be used to provide power from the drive shaft to respective ancillary or auxiliary equipment of the vehicle.

4. A vehicle as claimed in claim 3 wherein the power coupling is a pulley to which a belt or drive chain can be associated in order to provide power to the ancillary or auxiliary equipment.

5. A vehicle as claimed in any preceding claim wherein a starter motor is associated with the flywheel/clutch assembly in order that that starter motor may drive the driver shaft in order to initiate operation of the prime mover.

6. A vehicle as claimed in any preceding claim wherein the drive shaft 2 is associated with the flywheel/clutch assembly through a spline joint therebetween.

7. A vehicle as claimed in any preceding claim wherein the flywheel/clutch assembly is associated with the transmission through a spline coupling to the gear train of that transmission.

8. A vehicle as claimed in any preceding claim wherein the flywheel/clutch assembly is located within a housing upon bearings such that the mass of the flywheel/clutch assembly is not taken by the drive shaft.

9. A vehicle substantially as hereinbefore described with reference to the accompanying drawings.

10. A transmission arrangement for a vehicle, the arrangement comprising a gear train arranged whereby there is a hollow path defined therethrough in order to accommodate a drive shaft which is coupled to a prime mover on one side of the arrangement and a clutch/flywheel assembly on the other whereby a prime mover may drive the drive shaft and the clutch/flywheel assembly may drive the transmission arrangement.

11. An arrangement as claimed in claim 10 wherein the hollow path is central through the gear train of the transmission such that a gear train shaft upon which respective gears of the gear train are located essentially defines the hollow path through which the drive shaft is concentrically located.

12. An arrangement as claimed in claim 10 or claim 11 wherein at one end of the drive shaft there is a power coupling which may be used to provide power from the drive shaft to respective ancillary or auxiliary equipment of the vehicle.

13. An arrangement as claimed in claim 12 wherein the power coupling is a pulley to which a belt or drive chain can be associated in order to provide power to the ancillary or auxiliary equipment.

14. An arrangement as claimed in any claims 10 to 14 wherein a starter motor is associated with the flywheel/clutch assembly in order that that starter motor may drive the driver shaft in order to initiate operation of the prime mover.

15. An arrangement as claimed in any claims 10 to 14 wherein the drive shaft 2 is associated with the flywheel/clutch assembly through a spline joint therebetween.

16. An arrangement as claimed in any claims 10 to 15 wherein the flywheel/clutch assembly is associated with the transmission through a spline coupling to the gear train of that transmission.

17. An arrangement as claimed in any claim 10 to 16 wherein the flywheel/clutch assembly is located within a housing upon bearings such that the mass of the flywheel/clutch assembly is not taken by the drive shaft.

18. An transmission arrangement substantially as hereinbefore described with reference to the accompanying drawings.

Application No: GB 9917062.3 **Examiner:** Tom Sutherland
Claims searched: 1 - 17 **Date of search:** 10 December 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B7H (HDT, HDV, HDJ)

Int Cl (Ed.6): B60K 17/02, 17/06, 17/08

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2070533 A	(BL CARS) See Fig. 2 and page 1 lines 79 to 113.	10 to 17.
X	GB 0780654	(KAYE) See Figs 1 and 2.	1, 10
X	GB 0503273	(FORD) See Figs 1 and 3	10 to 12, 17
X	GB 0335667	(WILDE) See the Figs.	10, 11
X	GB 0306997	(CLARKE) See the Figs.	1, 2, 10, 11
X	GB 0289101	(STOCK) See the Fig.	10, 11

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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